(12) UK Patent Application (19) GB (11) 2 136 352 A

(43) Application published 19 Sep 1984

(21) Application No 8332240

(22) Date of filing 2 Dec 1983

(30) Priority data

(31) 8234587 (32) 3 Dec 1982 (33) GB

(51) INT CL³
G03H 1/04 B42D 15/02

(52) Domestic classification
B6A C13 C21 C51 K
G2J 33B

(56) Documents cited
GB 1541917
GB 1517840
GB 1515652

(58) Field of search
B6A

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(54) Hologram Devices and Method of Manufacture

(57) A hologram device for security or identification purposes is made from a plurality of transparencies (Figure 1) so as to display a complex three-dimensional image. The holographic image is embossed into thermoplastic ink printed on a plastics sheet, and the resultant embossed sheet is metallised and then partially de-metallised. The hologram device is used as a bridging seal (Figure 9) across two surfaces (74), such as a video cassette box. Any attempt to tamper with or copy the hologram damages the embossed thermoplastic ink layer which is weaker than the plastics sheet.

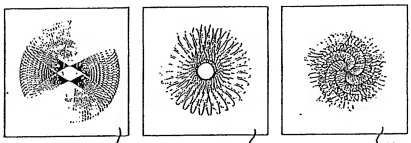

Fig.1

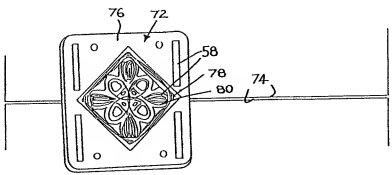

Fig. 9

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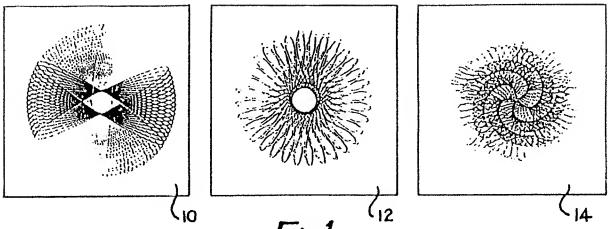


Fig.1

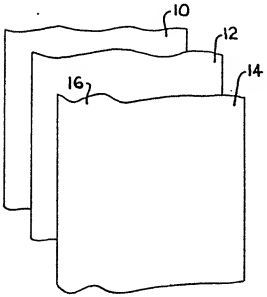


Fig.2

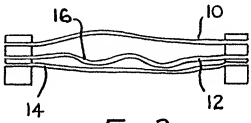


Fig.3

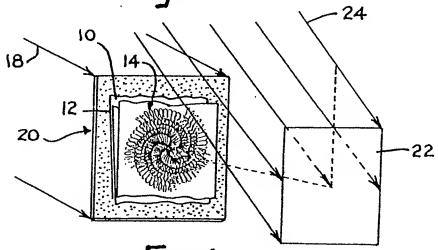


Fig.4

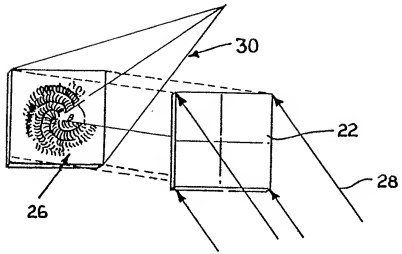


Fig. 5

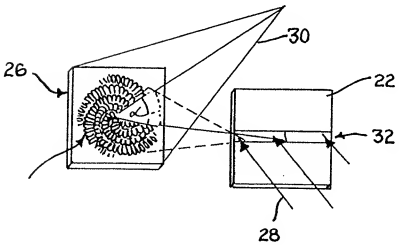


Fig. 6

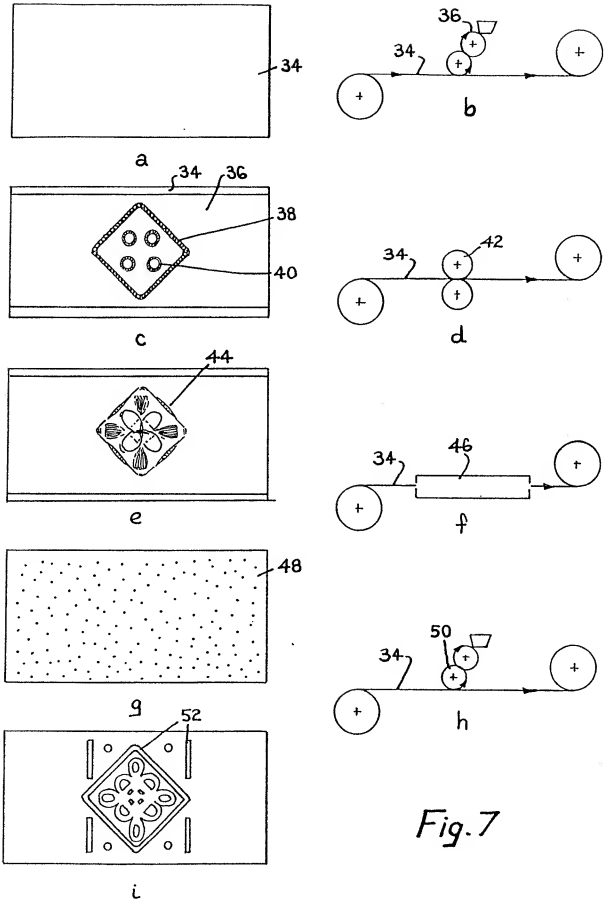
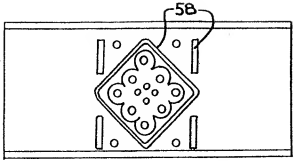
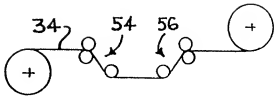


Fig. 7



a



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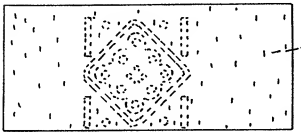
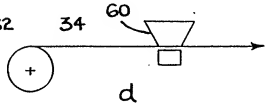
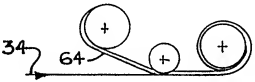


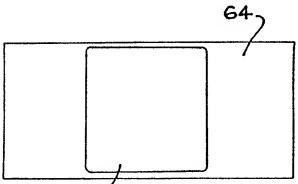
c



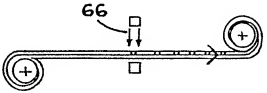
d



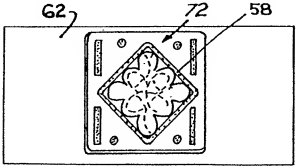
e



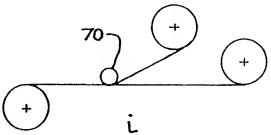
f



g



h



i

Fig. 8

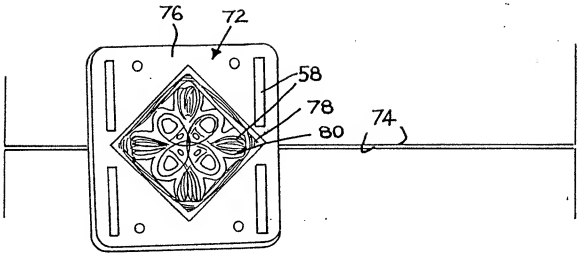


Fig. 9

SPECIFICATION

Hologram Devices and Methods of Manufacture

Field of the Invention

This invention relates to hologram devices for security or identification purposes, and to methods of manufacture thereof.

Background to the Invention

Documents such as passports, bank notes, identity cards, insurance policies and legal documents, securities, stock certificates, bonds, titles, licences, birth certificates, travellers' cheques, vouchers and tickets may be important or valuable, and the need to verify that they are genuine is correspondingly vital. Human lives and property may be at stake if enemy or criminal elements have the ability to forge or falsify such documents. Similarly, there is a growing trend for commercial products (such as video cassettes) to be imitated in design and packaging so that inferior goods are sold in place of bona fide brands of established reputation. There is clearly a need for an inexpensive, easily recognisable, highly secure means for protecting these items.

Summary of the Invention

According to one aspect of the invention there is provided a hologram device for security or identification purposes, comprising at least two adjoining layers of differing strengths, the hologram displaying a three-dimensional image and being incorporated in the weaker layer, so that an attempt to tamper with the hologram damages the weaker layer and the hologram carried thereby. The layers will be of such relative strengths that it will be virtually impossible to obtain a physical imprint of the surface-relief information of the hologram, because any attempt to do this will irreversibly damage the weaker layer.

In a preferred embodiment, the hologram is embossed into the weaker layer which is conveniently formed by thermoplastic ink printed onto a transparent synthetic plastics sheet which forms the stronger layer and through which the hologram can be viewed. The embossed layer may be partially metallised (preferably by first vacuum coating and then partially demetallising the metal coating), the metallised coating preferably overlapping the area of the hologram.

According to another aspect of the invention there is provided a method of making a hologram device for security or identification purposes, the device having at least two layers of differing strengths, the method comprising applying a hologram with a three-dimensional image to a first layer of material and bonding the first layer of material to a second layer of material, the material of the second layer being stronger than the material of the first layer so that an attempt to tamper with the hologram damages the weaker layer and the hologram carried thereby. Preferably, a thermoplastic ink, forming the first layer, is printed onto a plastics sheet forming the second layer, and the hologram is embossed into the ink on the plastics sheet.

The embossed plastics sheet may be metallised and then partially demetallised to leave certain areas, overlapping the hologram, metallised.

In the preferred method to be described, the hologram is made from a subject formed by a plurality of transparencies having different patterns, the transparencies being overlapped or laid one on the next in a stack and being subject to random deformations so that there are variable spaces between adjacent transparencies in the stack whereby to introduce variation in the Moire pattern of the hologram, rendering duplication of the hologram extremely difficult.

A first hologram plate may be formed by illuminating the stack with laser light, and the first hologram plate is then illuminated to form a second hologram plate, the latter being used to produce a photoresist copy which is then vacuum coated and electroplated to form a nickel master which is used to apply the hologram to said first layer. In this case the whole of the first hologram plate may be illuminated by a collimated light beam and the second hologram plate is illuminated by a reference beam, to transfer the holographic image from the first hologram plate to the second hologram plate, the latter being achromatic when viewed in white light. Alternatively, a narrow strip of the first hologram plate may be illuminated by a collimated light beam and the second hologram plate is illuminated by a reference beam, to transfer the holographic image from the first hologram plate to the second hologram plate, the image in the latter having a rainbow colour.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 shows three complex line-pattern transparencies for forming the hologram subject,

Figure 2 shows the three transparencies arranged in overlapping relationship with random deformation,

Figure 3 is a plan view of the transparencies of Figure 2,

Figure 4 shows the three transparencies being illuminated by laser light to form a corresponding holographic image on a first hologram plate,

Figure 5 shows the first hologram plate being used to form a reconstructed image on a second hologram plate,

Figure 6 shows an alternative way of forming a reconstructed image on the second hologram plate,

Figures 7(a) to (i) show diagrammatically how a plastics sheet has an embossed hologram applied thereto and is subsequently metallised,

Figures 8(a) to (i) show how the metallised embossed plastics sheet is partially demetallised, and the individual hologram made available for removal from backing paper, and

Figure 9 shows the resulting hologram forming a bridging seal across two adjacent surfaces.

Detailed Description of the Drawings

Referring to Figure 1 the transparencies 10,12 and 14 have different complex line patterns, similar to the complicated scroll patterns on bank notes. The three transparencies 10, 12,14 are given random deformations 16 so that when they are laid one on the next in a stack (Figures 2 and 3), spaces occur between adjacent transparencies. As shown in Figure 4, the stack of transparencies 10, 12 and 14 is illuminated by laser light 18 through a sheet of ground glass 20, in order to form a holographic image of the transparencies as subject onto a first hologram plate 22 illuminated with a collimated reference beam 24. The resultant three-dimensional holographic image is very difficult to duplicate because the randomness of the deformations in the transparencies 10, 12, 14 gives particular variations in the Moire pattern of the hologram.

Figure 5 shows a reconstructed image of the three transparencies formed on a second hologram plate 26. This is done by illuminating the first hologram plate 22 with a collimated reference beam 28, and illuminating the second hologram 26 with a reference beam 30.

The whole surface of the first hologram plate 22 is illuminated by the beam 28, and the resulting image on the plate 26 has both vertical and horizontal parallax and is colourless or achromatic when viewed in white light.

Figure 6 shows an alternative to Figure 5. In Figure 6 a thin horizontal strip 32 (about 3 to 5mm) of the plate 22 is illuminated by the collimated beam 28, giving a rainbow colour to the image in the second plate 26 and horizontal parallax only. The angle between the reference beam 30 and the horizontal strip 32 of the plate 22 determines the colour which is visible at the midpoint of the hologram when viewed in white light.

The hologram on the second plate 26 is converted to a photoresist copy which is then vacuum coated with metal and electro-plated to form a nickel master. This nickel master is then used to make embossed holograms, as will now be described with reference to Figures 7 to 9.

Figure 7(a) shows a plastics sheet 34 of transparent polyester. This sheet 34, forming a substrate, is printed with thermoplastic inks, preferably of different colours, which are applied by rollers 36 (Figure 7(b)). In the example shown in Figure 7(c), the sheet 34 has three translucent colours printed on the areas shown at 36, 38, 40 respectively. The printed substrate 34 is next embossed with the security hologram, using the nickel master previously mentioned. This is shown in Figure 7(d) where the rollers 42 indicate the embossing stage.

The resulting hologram device 44 (Figure 7(e)) has the hologram embossed into the thermoplastic inks which are supported by the plastics sheet 34. Areas of the hologram device 44 may be partially metallised, as will be described with reference to Figure 7(f) to 8(b), but this is optional and if not required the next stage is that depicted in Figure 8(c).

Assuming metallisation is required, the embossed sheet 34 is metallised by vacuum coating as indicated at 46 in Figure 7(f), the whole surface of the embossed side of the sheet 34 having a metal coating 48 (Figure 7(g)) thereon. Selected areas of the sheet 34, where it is desired that the metal should remain after demetallisation, are printed with a protective varnish—as indicated at 50 in Figure 7(h)—and these areas are shown at 52 in Figure 7(i).

The plastics sheet 34 is next treated with caustic soda at station 54 (Figure 8(b)), followed by clean water rinsing at a washing station 56, to remove metal from the areas unprotected by the varnish. The protected areas of metal are shown at 58 in Figure 8(a).

The plastics heet 34 is then treated with a strong permanent adhesive, as indicated at 60 in Figure 8(d), so that an adhesive coating 62 is applied to the embossed surface (Figure 8(c)). The plastic film treated with adhesive is then inter-wound with silica release paper 64 (Figure 8(e)). The silica paper backed plastics sheet is then kiss-cut with a die cutter 66 (Figure 8(g)) to cut through the plastic sheet 34 but not the release paper 64. The kiss cut holographic device 68 is shown in Figure 8(f).

The plastics borders or edges are removed at 70 (Figure 8(i)) from the holographic device on the silica paper, the resultant holographic device 72 (Figure 8(h)) being removable from the silica backing paper 64.

Figure 9 shows the resulting holographic device forming a bridging seal across two adjacent surfaces 74. The device is applied to the surfaces 74 with the sheet 34 outermost, so Figure 9 shows the device as viewed through the transparent sheet 34, with the embossed layer firmly held against the surfaces 74 by the adhesive applied at 60.

In Figures 8(h) and 9, the demetallised areas are indicated at 76, the metallised areas at 58, the pigmented areas at 78 and the embossed hologram generally at 80.

The layer 34 forms a substrate which is stronger than the layer of the thermoplastic inks particularly in resistance to attempted peeling. Hence, any attempt to tamper with the hologram damages the weaker layer of the inks and the hologram embossed therein.

The above description is a preferred way of putting the invention into effect. A number of alternatives and refinements are possible, as will now be described.

It is desirable to create a unique subject for the hologram used in the device; thus a suitable set of graphic or photographic designs for a multiple level composite image is a 'web' of fine line patterns, such as the sort of complex whirls and scrolls which are to be found on bank notes. The effect of parallax in this instance is to create a

distinct Moire pattern as the various levels of fine-line patterns or 'webs' appear to move relative to one another due to the depth of image between them. The important feature of the Moire pattern thus generated is that it is unique to the exact collective arrangement of all the diverse levels of artwork. Were but one level to be displaced the Moire pattern would be altered. An image structure such as the one described would be doubly secure, posing the problem not only of initially extracting the graphic designs but also of subsequently rearranging them to exactly match the original.

An alternative to the method for incorporating two-dimensional artwork into the hologram described above is to print the web of fine line patterns on to sheets of clear glass, in a reflective metallic ink and sandwich them together. The 'sandwich' thus constructed is used as the subject of a laser transmission hologram, a thin horizontal strip of which is then projected onto a second hologram plate to form a rainbow hologram. If a plurality of strip holograms are made in this way and are each exposed separately onto the final hologram at different angles relative to the final reference beam, then the three sandwiches will each appear in separate colours (relative to each other) yet they will all appear to co-exist spatially. Being thus spatially fused together, they are intelligible to a human observer, but could not be separately resolved photographically.

A further extension of the above method is to print the fine line patterns not on rigid glass, but upon flexible plastic. When the sandwich structure is assembled, the individual sheets of clear plastics (each bearing a complex pattern), are allowed to twist, bend, or become corrugated rather than lie flat, Thus when several of such sandwich structures are superimposed in the final hologram, they will be fused together in every direction. The element of random assembly in this method is a further advantage because it would be difficult even for the makers of the genuine hologram to recreate the original assembly and Moire pattern, though they were still in possession of all the original artwork. In this way, the object formed in the embossed hologram device is like a fingerprint in three dimensions and the Moire pattern formed is unique.

For a number of the proposed applications of the present invention, it may be an advantage to have a more recognisable three-dimensional object. As before, it is desirable that the object be very difficult to reproduce. A preferred object is a shallow sculptured scene, such as those engraved on medallions, military medals, or large coins. Such an engraving specially commissioned for the hologram, would be very difficult to imitate working from the image alone.

Further means of making the three dimensional (or multi-level artwork) secure from imitation include procedures for making the colour and lighting arrangements within the hologram as complex as possible.

Firstly, by an extension of the rainbow hologram method described, it is possible to create secondary spectral colours by multiple exposure. Different colours are caused either by altering the angle of the slit holograms relative to the angle of the reference beam between exposures or by altering the angle of the reference beam, relative to the position of the strip holograms. When two such separate colours overlap they form a secondary spectral colour, being the mixture of the two primary spectral colours. It makes no difference whether the overlap of the different colours is on the same spatial plane or on a different spatial plane, or whether the image in question is a two-dimensional graphic or a three-dimensional object, both image elements will be clearly viewable, either one appearing behind the other or both seeming to co-exist spatially.

As the method of creating a mix of colours contains the option of either moving the angular orientation of the strip hologram or of the reference beam, it is deemed preferable to use both options in different image elements within the same hologram. In this way, it would be difficult for a potential forger to know which technique to employ to achieve the correct colour mix for any one particular element in the image.

A full colour mix may be achieved by correctly aligning three primary spectral colours to form an achromatic image. An achromatic image may be desirable because it may be printed into a plastic tinted with ink or pigment, to produce a conventional colour (as opposed to a prismatic colour) to match the hues of a flag, company logo or emblem etc.

Achromatic images may also be formed of shallow objects which are directly focussed from a laser transmission hologram onto a second hologram plate without the usual restriction of the laser transmission hologram to a thin horizontal strip as in the rainbow hologram technique. Such objects may not exceed about 0.5 inches in depth or they become blurred when viewed in white light illumination. Larger objects may be used in this process in conjunction with a lens. The real image of the object projected by the lens is focussed directly onto the plane of the final hologram, thus obviating the need for a first laser transmission hologram.

A final means of securing a unique object which can in no way be duplicated by imitation is to include within the hologram a multiplexed image. US Patent No. 4,206,965 describes a system by which a three-dimensional image may be synthesized by recording a large number of two-dimensional views of an object. In this way, subjects normally unsuitable for holograms may be used. For example, a portrait may be built up of a human subject. Were such an image to be formed of the Head of State or some other dignitary, an object would be formed which a forger would be unable to duplicate. By extension, not only still images, but moving pictures may be formed by the process disclosed, thus a unique

event, such as the launch of a space rocket or some other singular footage, would serve as an object which could not be imitated to form the basis of a spurious hologram.

Forgery by contact-copying using a single beam of coherent monochromatic light (the method described in US Patent No. 3,758,186 for example) poses a greater threat than forgery by imitation, which requires artistic, as well as holographic skills.

One method of preventing a copy hologram from being formed is to 'code' the reference beam as, for example, by scrambling the light through a diffuser (such as a sheet of ground glass).

A preferred method is to mask the surface of the final hologram into several distinct areas and expose separate slit holograms, or a plurality of slit holograms, onto these distinct areas, using contrary reference angles. The reference beams may also be of dissimilar wavefronts, such as diverging, converging or columnated, or of other configurations generated by various irregular lenses or mirrors. By this method contact copying by the single beam method is prevented as no single wavefront is capable of reconstructing more than a small portion of the hologram. The effectiveness of this process is dependent upon the intricacy of the mask used to delineate the several wavefronts used to reconstruct the diverse areas. This method is best used in conjunction with the systems already described above for creating a plurality of mixed colours within the hologram device by moving the angle of the reference beam relative to the strip hologram. The final result is an image of such optical intricacy that it would require several reference beams, each of the correct wavefront formation, to be accurately aligned to the correct portion of the hologram surface.

To further extend the security of the hologram device, small areas of the surface may be exposed to form tiny laser transmission holograms requiring their own reference beams. These areas would act like watermarks in a banknote to be verified, by those who knew where to look for them, by laser illumination.

The laser transmission holograms may also be formed in such a way as to allow it to be verified by machine. A small laser diode may be employed to reconstruct the tiny laser transmission hologram which is 'read' by photo-sensitive cells, which in turn transmit the information to a microprocessor.

The most serious threat to the hologram security device proposed is by mechanical duplication by casting, or some other means, by which the surface relief information which forms the hologram is physically imprinted on to some material from the surface of the embossed plastic hologram device. This method requires no specialized skills or knowledge of holography and therefore will be the method to attract most potential forgers of the embossed hologram security device. It is for this reason that the invention provides layers of differing strengths, with the hologram in the weaker layer.

In this process, continuous rolls of thin transparent plastic film are passed between two heated metal rollers at least one of which bears a metallic master of the surface relief security hologram. The thin transparent film may be given a coating of a reflective metal, such as aluminium, prior to receiving the embossed imprint of the security hologram, or alternatively it may be metallised subsequent to the embossing step; in both cases the embossed plastic film is then given a coating of a strong adhesive as described, prior to being interwound with a silica 'release' paper, to prevent the plastic film from sticking to itself when wound into rolls. Having been backed with a silica 'release' paper, the rolls of plastic film are die-cut to form self-adhesive, label-like security devices, or sliced into thin rolls of self-adhesive security tape, depending on the final application.

The security tape and labels may be easily separated from the silica 'release' paper and firmly bonded onto any flat surface. If any attempt is made to remove by mechanical force the embossed hologram security device from the surface onto which it has been bonded the thin plastic will stretch, warp and otherwise distort, showing clearly that an attempt has been made to tamper with the device. If an attempt is made to use heat or chemical solvents to remove the embossed hologram security device from the surface onto which it has been bonded, the plastic film into which the security hologram has been embossed will perish before the adhesive can be removed, thereby safeguarding the surface-relief information of the security hologram from the threat of duplication by means of casting or imprinting.

A preferred method is to emboss the security hologram into a two-ply structure of thermoplastic film. By this process a strong, thin transparent plastic (such as polyester) is used as a substrate for a further extruded layer of a weaker transparent plastic (such as polyvinyl chloride) which is embossed with the surface-relief security hologram in the manner already described, by heating the two-ply structure to a temperature sufficiently high to melt the surface of the weaker plastic, into which the hologram is embossed, but not so high as to affect the stronger supporting layer of plastic film. Ideally, the layer of the weaker plastic should be of a thickness close to that of the depth of the surface-relief information which forms the security hologram. After the embossing step, the surface of the embossed plastic layer is covered with a reflective metallic coating, prior to being covered with a strong adhesive, as in the method already described, prior to being backed with silica 'release' paper and being die-cut and/or sliced into thin rolls. The finished security hologram tape, sticker or label is then viewed through the stronger plastics layer.

If any attempt is made to remove by mechanical force the hologram security device formed by this method from the surface onto

which it has been bonded, the device will split laterally into two halves between the two layers of platic, thereby leaving thin ridges of the surface-relief hologram floating unsupported in the strong adhesive, from whence they may not be extricated.

An additional step which may be included in the processes described, which further enhances the optical and the physical security of the invention, is to de-metallise selected areas of the metallised embossed security hologram.

There are two preferred methods by which the de-metallisation of the embossed security hologram may be achieved. By the first method, the embossed metallised plastic film is printed with a protective layer of varnish in selected areas, prior to being passed through a bath of caustic soda, or being spray-washed with jets of caustic soda, to remove the metallic coating from the plastic in those areas which are *not* protected by the varnish layer. embossed with the security hologram.

By the second method, a water-soluble protective layer is selectively printed onto the single (or multiple) layered plastics film after it has been embossed with the security hologram, but prior to the metallising process. In this way, the metallic coating adheres to the embossed security hologram only in those areas which have *not* been covered by the water soluble protective coating, elsewhere the metallic coating clings to the surface of the protective layer. The plastics film is subsequently bathed and the water-soluble protective layer is dissolved by washing, the metallic coating being removed at the same time along with the protective layer. The partially metallised embossed plastics film then proceeds to the adhesive, and subsequent stages as described.

The advantages of including the de-metallisation step in the invention are as follows: firstly, the range of applications is extended to those where a semi-transparent security device is required as, for example, in applications where the device is to be bonded onto a document in such a way as to allow indicia on the document to show through the embossed security hologram, as, for example, in the case of a passport photograph where it is important that the major part of the photograph is not obscured from view, whilst at the same time a portion such as one corner of the photograph is covered by the metallised embossed hologram security device which bonds it to the surface of the passport page. De-metallising a portion of a larger sheet of plastics film allows the photograph to be entirely covered by the area of the film, whilst still remaining viewable through the hologram. Similarly, areas of the embossed security hologram must remain transparent on documents where a signature, or some alpha-numerical data or other indicia must remain visible when covered by the embossed hologram security device.

The demetallised portion of the embossed hologram security device may also be in the form of complex fine line patterns which are precisely in register with a two- or three-dimensional design in the image of the embossed hologram, thereby adding a further complexity to the design as an additional measure against forgery.

A preferred method (as herein described with reference to the drawings) for fabricating a two-ply plastics film structure is to print thermographic inks onto a strong polyester plastic substrate film and emboss the holographic security device into the thermographic ink layer. This system allows for greater control over the thickness of the soft plastic ink layer making it possible to more accurately match it to the depth of the hologram surface-relief information. It also offers the additional advantage of co-ordinating full colour pigmented patterns or graphic designs with the hologram images in the manner previously described for embossing on to a thermoplastic ink coated paper substrate. This method of embossing the holographic security device into thermoplastic inks on a plastics support member is also advantageous in a number of applications using thick sheets of plastics, such as credit cards or identity cards. Indeed, any object may be embossed by this method which has surfaces suitable for printing with thermoplastic inks.

A further sophistication of the method of embossing into a two-layered plastics structure is to emboss the hologram into a multiple layer structure. In this procedure both the top and bottom surfaces of the strong plastics film support are printed with a thermoplastic ink. One surface is printed with pigmented inks whilst the other is printed with a uniform layer of transparent ink. Two cylindrical embossing rollers are employed to emboss both surfaces. The principal hologram is embossed into the pigmented layer, to be viewed through the support plastics and the transparent layer into which a second, modifying hologram image is embossed. For example, two images or sets of artwork in primary spectral colours might be used which, in conjunction, would produce a secondary spectral colour; or alternatively, the modifying hologram may be a simple grating which renders the principal rainbow hologram achromatic. Both holograms are covered with the strong adhesive, as described, and the transparent, 'modifying' hologram side then covered with a further layer of tough plastics, whilst the principal hologram side is backed with silica release paper as before. Alternatively, the modifying hologram may be simply coated with a second transparent ink of a different refractive index to the first. The resulting hologram security device would split in two along the layers of the thermoplastic ink visibly destroying the hologram and indicating the device had been tampered with.

A final method for encapsulating the embossed security hologram is to bond a further layer of strong, thin plastics to the strong, permanent-adhesive layer already described. This forms a multiple layer structure, inside which the security

hologram is buried beneath protective layers which are more physically and chemically resistant that that into which the security hologram is embossed. This particular structure has the advantage that the final layer is not an adhesive, and can be used for applications requiring a non-adhesive security film. For example, such film might be used, in conjunction with a heat-sealing device, to encapsulate valuable objects or commercial goods to secure them against tampering. Betting office slips, wage packets, drugs and medical goods, together with toiletry and perfumery packaging, video films, audio cassettes and numerous other articles benefit from such tamper-proof wrapping.

It will be clear from the foregoing description that the embossed security hologram device may be generated by a number of different methods and manufactured in a variety of ways to suit diverse applications. In all cases, the invention provides for a white-light viewable hologram, which bears an image in three-dimensions or a plurality of two dimensional images at different depths having parallax in at least one direction, such that the image may not be imitated holographically, by first reproducing the image photographically. In all cases the invention provides for a hologram which is optically complex, such that it may not be reproduced holographically by means of contact-copying with a single beam; and in all cases the invention provides the manufacture of the security device, preferably by embossing the security hologram into a themoplasticin such a way as to prevent the subsequent casting or imprinting of the security hologram in order to procure a forged copy. In all cases the embossed hologram security device is used as a method of authenticating, validating or sealing a valuable item, commercial object or document.

CLAIMS

1. A hologram device for security or identification purposes, comprising at least two adjoining layers of differing strengths, the hologram displaying a three-dimensional image and being incorporated in the weaker layer, so that an attempt to tamper with the hologram damages the weaker layer and the hologram carried thereby.

2. A hologram device according to claim 1, wherein the hologram is embossed in the weaker layer.

3. A hologram device according to claim 2, wherein the hologram is embossed into thermoplastic ink forming the weaker layer.

4. A hologram device according to any of the preceding claims, wherein the stonger layer is a sheet of a transparent synthetic plastics material through which the hologram can be viewed.

5. A hologram device according to any of the preceding claims, wherein metallised areas at least partially cover the hologram, other areas being de-metallised.

6. A hologram device according to any of the preceding claims, wherein the hologram is made from a plurality of complex line-patterns transparencies.

7. A method of making a hologram device for security or identification purposes, the device having at least two layers of differing strengths, the method comprising applying a hologram with a three-dimensional image to a first layer of material and bonding the first layer of material to a second layer of material, the material of the second layer being stronger than the material of the first layer so that an attempt to tamper with the hologram damages the weaker layer and the hologram carried thereby.

8. A method according to claim 7, wherein a thermoplastic ink, forming the first layer is printed onto a plastics sheet forming the second layer, and the hologram is embossed into the ink on the plastics sheet.

9. A method according to claim 8, wherein the embossed plastics sheet is metallised and then partially de-metallised to leave certain areas, at least partially overlapping the hologram, metallised.

10. A method according to any of claims 7 to 9, wherein the hologram is made from a subject formed by a plurality of transparencies having different patterns, the transparencies being overlapped or laid one on the next in a stack and being subject to random deformations so that there are variable spaces between adjacent transparencies in the stack, whereby to introduce variation in the Moire pattern of the hologram, rendering duplication of the hologram extremely difficult.

11. A method according to claim 10, wherein a first hologram plate is formed by illuminating the stack with laser light, and the first hologram plate is illuminated to form a second hologram plate, the latter being used to produce a photoresist copy which is then vacuum coated and electroplated to form a nickel master which is used to apply the hologram to said first layer.

12. A method according to claim 11, wherein the whole of the first hologram plate is illuminated by a collimated light beam and the second hologram plate is illuminated by a reference beam, to transfer the holographic image from the first hologram plate to the second hologram plate, the latter being achromatic when viewed in white light.

13. A method according to claim 11, wherein a narrow strip of the first hologram plate is illuminated by a collimated light beam and the second hologram plate is illuminated by a reference beam, to transfer the holographic image from the first hologram plate to the second hologram plate, the image in the latter having a rainbow colour.

14. A hologram device constructed and arranged substantially as herein particularly

described with reference to the accompanying drawings.

15. A method of making a hologram device, substantially as herein particularly described with reference to the accompanying drawings.

Printed in the United Kingdom for Her Majesty's Stationery Office, Demand No. 8818935, 9/1984. Contractor's Code No. 6378.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.